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PERIOPERATIVE MORBIDITY AND MORTALITY AFTER EMERGENCY AND ELECTIVE COLON AND PROXIMAL RECTAL SURGERY IN IBADAN

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ABSTRACT

Objectives: **While the epidemiology of benign colonic pathologies has not significantly changed in our region, colorectal cancer has steadily increased with a majority of patients presenting with late stage disease particularly large bowel obstruction. This study reviews the outcome of emergency and elective colon and proximal rectal cases with regards to perioperative morbidity and mortality.**

Setting: **All patients who had surgery for symptoms of lower gastrointestinal tract disease (caecum and proximal rectum) between January 2008 and January 2018 at University College Hospital, Ibadan were included. Data regarding elective or emergency presentation, peri-operative findings, operative details and post-operative course were recorded prospectively.**

Results: **Out of the 1618 patients with symptoms, 817 were operated on as emergencies (38.1%) and electives (61.9%). The median age of patients who had emergency and elective surgery were 56 (33-81) and 59 (27-87) respectively (p-0.05). Right hemicolectomy (152; 18.6%) was the commonest procedure, followed by anterior resection (115; 14.1%) and colostomy (114; 13.9%). Overall morbidity was 13.7% (elective 4.2%; emergency 9.5%), while mortality was 6.8% (elective 2.1%; emergency 4.7%). The commonest morbidities were superficial surgical site infection (SSSI) and wound dehiscence. Bowel perforation or gangrene was the most significant predictor of mortality.**

Conclusion: **Large bowel obstruction complicated with perforation and gangrene is a major risk factor for morbidity and mortality in colorectal surgery.**

INTRODUCTION

Colorectal cancer has steadily increased in sub-Saharan Africa over the last 20 years[1-4], with about two - fifth of patients presenting with late stage disease[4,5]. One of the commonest modes of presentation of advanced disease are symptoms of large bowel obstruction necessitating emergency treatment, which often leads to an increased morbidity and mortality[6]. The epidemiology of benign colonic pathologies has not changed significantly over time in our region; except for the noted reduction in colonic intussusception and sigmoid volvulus which hitherto accounted for a large volume of emergency colon surgeries[7-11]. The outcomes following emergency and elective colorectal surgeries have been well studied with documented morbidity and mortality rates of between 1-30% [12-15]. We prospectively reviewed all colon and proximal-rectal surgical cases done since 2008 with the aims of auditing our outcomes with regards to perioperative morbidity and mortality. We also identified risk factors for peri-operative (in-hospital) mortality following colon and proximal rectal surgery in our practice.

METHODS

The study was undertaken at the Department of Surgery, University College Hospital, Ibadan between January 2008 and January 2018. Consecutive patients who had emergency or elective surgical intervention for lower gastrointestinal tract (caecum- proximal rectum) symptoms during the study period were included. Ethical approval was obtained from the state ethical review committee (AD 13/479/745) and conduct followed the guidelines of the Helsinki declaration on biomedical research in human subjects. Confidentiality of the identity of patients and personal health information was maintained.

Data regarding elective or emergency presentation, peri-operative findings, operative details, post-operative course and histopathology were recorded prospectively by the surgeon responsible for the surgical care of the patient. Mid- and distal rectal pathologies necessitating a perineal approach or operating below the peritoneal reflection were excluded. The emergency surgical cases were defined as unscheduled laparotomy due to acute symptoms necessitating emergency presentation at the emergency unit or intra-operative

obstetrics and gynaecological consults that had surgical intervention without the standard peri-operative work-up while elective colon surgical patients were reviewed and admitted via the surgical out-patients clinic. Resection was either segmental (anatomic) or partial (removal of the lesion- bearing segment). Primary anastomosis is defined as immediate restoration of bowel continuity and colostomy was either completely or partially defunctioning. Peri-operative short-term outcome was any sequelae attributable to surgical intervention which occurred in the first 30 days post-operatively.

Pre-operative care

All the patients had necessary clinical and radio-pathologic diagnosis made. Routine cardiorespiratory, hematologic and biochemical investigations were done on admission. All emergency cases had fluid and electrolyte, blood, antibiotic and bowel decompression as part of initial resuscitation before contemplating surgery. Cardiology, endocrinology and pulmonology consults were sought as required for identified comorbidities while pre-operative anaesthesia review was mandatory before surgical intervention. Left-sided colonic surgery entailed bowel preparation in the elective setting only. A consent for a colostomy was obtained in all cases before surgery especially in the emergency setting.

Operative procedure

All the patients had an exploratory laparotomy under general anaesthesia except for extremis cases which necessitated mini-laparotomy for decompression under regional or local anaesthesia.

Post-operative care

This entailed care in either the ward, high dependency unit (HDU) or the intensive care unit (ICU). Deep venous thrombosis prophylaxis was discontinued after ambulation was established. Parenteral medications were only changed to oral when bowel function returned, indicated by the passage of flatus or faeces. Empirical antibiotics were given prophylactically or until features of sepsis resolved. Hospital discharge occurred between a week and ten days after laparotomy and was variable for the emergency surgical cases.

Out- patient care was at 2 weeks (histology or stoma/ wound review); 4 weeks (ascertain full recuperation or commencement of adjuvant treatment for malignancy) and at 8 weeks (discharge or work up for closure of stoma).

Statistical Analysis

All information was recorded in Microsoft excel spread sheet. Data analysis was done using the SPSS version 20.0. Descriptive data were summarized using percentages, ratios and proportions for categorical data and measures of central tendency for continuous variable. Mann-Whitney U test was used to assess differences between proportions when appropriate. Univariate analysis was done with the Pearson chi-square test and Fischer's exact test. Multivariate analysis was performed using logistic regression. Relationships and differences was considered statistically significant when the P value was ≤ 0.05.

RESULTS

Out of a total of 1618 patient seen with colorectal disease-related complaints, a total of 817 patients were operated on during the study period. Of these 38.1% presented as emergencies while 61.9% were managed as elective surgical cases. The cases that required

Table 1: Clinicopathologic and operative profile (n=817)

Characteristic	Number	Percentage
Sex		
Male	466	57.0
Female	351	43.0
Age		
16 – 40	92	11.3
41 – 65	542	66.3
> 65	183	22.4
Co-morbidity		
Hypertension	110	13.5
Diabetes	33	4.0
Asthma	4	0.5
COPD	13	1.6
Heart failure	36	4.4
Renal (AKI)	42	5.1
ASA		
I	90	11.0
II	188	23.0
III	261	32.0
IV	237	29.0
V	41	5.0
Cadre of Surgeon/Anaesthetist		
SR	364/590	44.6/55.4
Consultant	453/227	55.4/45.6
Post-op care		
Ward	474	58.0
HDU	180	22.0
ICU	163	20.0
Diagnosis		
Benign	503	61.6
Diverticular disease	94	11.5
Adhesions	29	3.5
Appendiceal pathology	41	5.0
Enterocutaneous fistula	25	3.0
Intussusception	14	1.8
Volvulus	74	9.0
Hernia	33	4.0
Iatrogenic/ Ob/Gyn/Others	193	23.8
Malignancy	314	38.4
Caecum	50	16.0
Ascending	31	9.8
Hepatic flexure	27	8.6
Transverse	29	9.2
Splenic flexure	17	5.4
Descending	13	4.1
Sigmoid	49	15.6
Proximal Rectum	98	31.2

COPD – Chronic Obstuctive Pulmonary disease AKI – Acute Kidney Injury ASA – American Society of Anaesthesiologists SR – Senior Registrar HDU – High Dependency Unit ICU – Intensive Care Unit Ob/Gyn – Obstetric/Gynaecology

emergency surgery included obstruction (68%), perforation (13%), diverticular disease (bleeding/ perforation – 11.5%), gynaecology related conditions (9%) and terminal ileal or appendiceal disease that necessitated a limited hemicolectomy (5%). The distribution of the surgical cases is highlighted in Table 1. Colon cancer, diverticular disease, iatrogenic Obstetrics/Gynaecology bowel injuries and volvulus were the most frequent cases done electively in descending order (Table 1).

Figure 1 shows the flow chart of patients treated during the study period. The mean age was 54 ± 9 years. Half of the patients were above 55 years of age. The prevalent co-morbidities were hypertension (110; 13.5%) and diabetes (33; 4%). The median age of patients who had emergency surgery was 56 (33- 81) compared to 59 (27-87) for the elective group. Patients who underwent emergency or elective surgery were predominantly male (466; 57%) with no statistical significance. Table 1 highlights the clinico-pathologic and peri-operative profile of the patients who underwent surgery.

Table 1 also shows that the most frequent surgical intervention was a right hemicolectomy, followed by anterior resection and then colostomies. The commonest benign indication was an inflammatory mass or phlegmon involving the terminal ileum, caecum and ascending colon from an appendiceal pathology.

The post-operative morbidity and mortality in the elective and emergency patients were compared in Table 2. A significantly higher mortality and morbidity was seen in emergency surgeries than in elective cases. The overall morbidity was 13.7% (elective 4.2%; emergency 9.5%), while mortality was 6.8% (elective 2.1%; emergency 4.7%).

There was a tendency to a diverting stoma as the only procedure during an emergency procedure than elective (p-0.06). A bypass surgery had a poorer outcome than a resection in either the emergency or elective arm (p-0.03). Uncomplicated large bowel obstruction (LBO) did not contribute significantly to morbidity or mortality (p-0.16); however, LBO complicated with either perforation or gangrene predicted mortality significantly (p-0.01).

Morbidity associated with right-sided resection was higher than with left-sided resection (p-0.02) in both

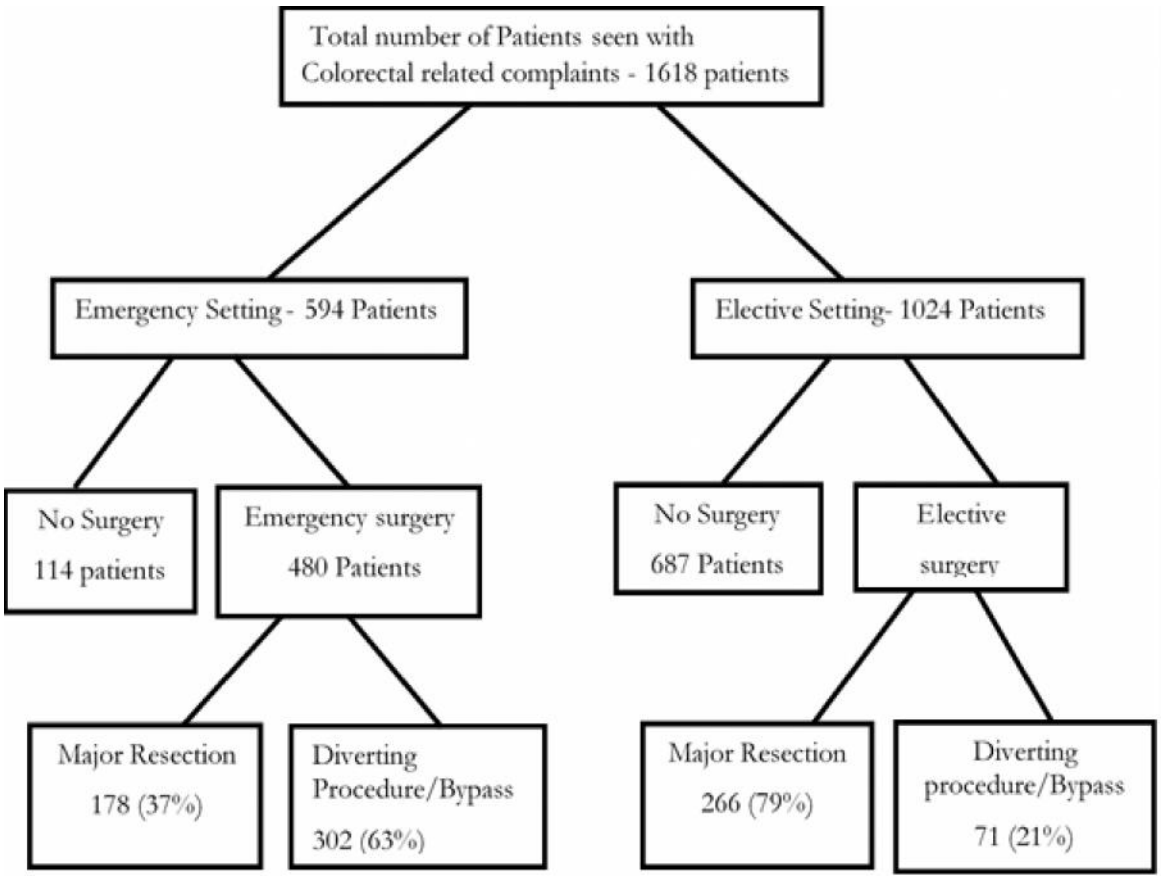

Figure 1: Flow chart of patients seen during study period

Table 2: Perioperative morbidity and mortality outcome after emergency and elective surgery.

	Emergency	Elective
Morbidity -112 (13.7%)		
Wound infection – SSSI	80 (9.8%)	32 (13.9%)
DSSI	19 (2.1%)	13 (1.6%)
Organ-space	21 (2.6%)	16 (1.9%)
Wound dehiscence	43 (5.3%)	24 (2.9%)
Sepsis	51 (6.2%)	22 (2.7%)
Anastomotic leak	21 (2.6%)	13 (1.6%)
Obstruction	19 (2.1%)	40 (4.9%)
Embolism	14 (1.7%)	17 (2.1%)
Myocardial infarction (MI)	8 (0.9%)	5 (0.6%)
Stoma complications – gangrene	9 (1.1%)	5 (0.6%)
Necrosis	8 (0.9%)	4 (0.5%)
Prolapse	11 (1.3%)	18 (2.2%)
Stenosis	4 (0.5%)	7 (0.8%)
Diarrhoea	34 (4.2%)	18 (2.2%)
Enterocutaneous fistula	26 (3.2%)	11 (1.3%)
Mortality -56 (6.8%)	39 (4.7%)	17 (2.1%)

SSSI – Superficial Incisional Surgical Site Infection, DSSI – Deep Incisional Surgical Site Infection

Table 3: Surgical procedure type and mode of presentation.

Procedure type/no	Elective	Emergency	Overall %
Colostomy/Bypass /114	21	93	14.0
Right Hemicolectomy/152	106	46	18.6
Extended Right Hemicolectomy/83	59	24	10.2
Subtotal colectomy/113	59	54	13.8
Left Hemicolectomy/67	49	18	8.2
Sigmoidectomy/73	51	22	8.9
Anterior resection/115	91	24	14.1
Hartmann's/41	11	30	5.0
Stoma reversal/59	59	0	7.2
Total = 817	506	311	

the emergency and elective surgery groups. The American Society of Anaesthesiologist (ASA) score was expectedly higher in the emergency surgery group and overall but only significant when higher than ASA III in the emergency setting (p-0.002) while the noted comorbidities did not determine outcome significantly. Left-sided faecal diversion surgeries resulted in more surgical site infections than left-sided resection and anastomosis (p-0.01).

Table 3 shows the surgical procedure and mode of admission. The cadre of surgeon (trainee vs Consultant) and time of surgery (day vs night) were also significant in determining the procedure being done, and a stoma was fashioned more by a trainee surgeon during the call hours mostly.

Approximately 7% of all patients requiring surgery could not be operated on due to unavailability of intensive care unit (ICU) beds.

Almost all patients (99.7%) of our patients had hand-sewn anastomosis. Only 0.3% of our patients had anastomosis done with a stapling device.

DISCUSSION

The present study represents a large heterogenous cohort of patients managed over a 10 year period in a typical surgical unit in sub-Saharan Africa with its inherent structural and technical challenges. The post-operative morbidity and mortality of colon and rectal surgery have been reported extensively with wide variability noted[14,15]. The total perioperative morbidity and mortality of 13.7% and 6.8% found in our study is slightly higher when comparing with the review by Masoomi et al[15] who analysed the Nationwide Inpatient Sample (NIS) in the United States of America. In this study by Masoomi *et al*[15], the overall rate of in-hospital mortality was 4.5%.

In comparing with other reviews[16, 17, 18, 19], the findings of an older patient-set with colorectal tumours

presenting with LBO as emergencies was similar to our findings. Of note is the fact that our study consisted of a heterogenous population with varied diagnosis as opposed to the homogenous cohort of the patients noted reviewed by other authors[6,20,21,22,23].

There is a higher morbidity and mortality related incidences in the emergency group irrespective of what type of procedure was carried out as highlighted in Table 2. In the emergency circumstances, the response time is important, and there is a need to optimise the patients' physiological state while also not unnecessarily prolonging the duration of peritoneal sepsis. This leads to an abridged resuscitation period where-in the thorough review, medical management of comorbidities along with a comprehensive risk assessment which are completed in the elective setting are aborted at the expense of the much-needed surgical intervention. This may explain the increase in the post-operative morbidity and mortality noted in this group. Co-morbidities were present in a quarter of patients operated on and it is an established fact that end-organ damage in patients undergoing colon/rectal surgery results in a higher morbidity and mortality[15]. Allied to this is the age of the patients which was mainly between the fifth and seventh decade of life in our study. Most studies assessing age and outcome agree that advanced age is a significant risk factor to be considered in pre-operative assessment[24, 25].

Overall the commonest procedure in our series was a right hemicolectomy, either a formal hemicolectomy for lesions in the proximal colon or a limited hemicolectomy for a terminal ileal or appendicular pathology. There was a preponderance of by-pass/ stoma surgeries in the emergency than the elective surgical groups and this may be a reflection of the emergency and unstable hemodynamic state of the patients in the perioperative period with little or no bowel preparation. More so the expertise available during the emergency hours may not be adept at attempting resection in this group of unstable patients. The incidence of perforation in malignancies is within the quoted range in other reports [17, 20, 22]. We confirm that bowel perforation/ gangrene is the most significant predictor of mortality in large bowel pathologies[31] as opposed to the finding by Sjo *et al* [16] who found no significant difference in morbidity and mortality when comparing bowel obstruction and perforation in their own series. The variation in patient demography may have contributed to this.

All complications noted in the emergency group were also observed in the elective population. However post-operative sepsis was significantly higher in the emergency surgical cases because of the factors inherent in the manner of presentation. This may include peritoneal soilage from bowel perforation and strangulation leading to severe sepsis. Closely allied to this is the ASA classification of patients for surgery.

The commonest morbidities noted were superficial surgical site infection (SSSI) and wound dehiscence which closely mirrored the findings by Sjo *et al* [16]. The procedures associated with the highest incidence of morbidity were sigmoidectomy and anterior resection. Our findings mirrored that of Core *et al* [25] who also showed a higher rate of mortality in left sided colon surgeries. In the emergency setting, performing a resection surgery had the worst outcome; closely followed by performing a diverting stoma or an ileo-transverse anastomosis. We found the Hartmann's procedure to be a versatile tool in managing left sided colonic pathologies, particularly in the emergency setting when avoiding the risk of an anastomotic leakage after surgical resection of a rectosigmoid lesion. Other authors[16, 21, 27, 28] opined differently with a $\geq$ 10% morbidity/mortality rate associated with the use of the procedure. These authors preferred an on-table lavage with primary anastomosis after a left sided resection. A randomized trial comparing Hartmann's procedure and left hemicolectomy in a comparable group of patients will assist in making a firm conclusion on the better of the two options. We however agree to the technicality associated with a stoma closure and fashioning of a colorectal anastomosis thereafter as a second stage procedure.

Peritoneal sepsis occurring after a primary resection and anastomosis was seen in 4.1% of patients, this necessitated a re-exploration and fashioning a stoma, this is comparable to the reports from other high volume centres[26]. It is trite knowledge that restoring bowel continuity after resection in emergency circumstance has a greater propensity to an anastomotic leak[28,32,33,34]. The subset analysis show that a greater percentage had the anastomotic leak in the emergency setting in our review, this was however not statistically significant and is akin to the findings by Choi *et al* [35]. An important guide that we imbibe is the operative time and intra-operative blood loss which are known surrogate markers of a difficult procedure [26,36, 37], if at the point of restoring bowel continuity, the operative time, blood loss or need for transfusion is high; we usually accompany our primary anastomosis with a proximal protective defunctioning stoma or use adjuncts like a pelvic drain.

In the face of faecal peritonitis and shock in the emergency setting, most patients only get a stoma in

our practise, this may on one hand increase the volume of patients requiring a second procedure; it however increases the chances of survival overall. The category of very ill and emergency patients requiring surgical intervention as a part of their resuscitation will be better served if a comprehensive intensive care unit, high dependency unit are available for the post-operative care. Indeed, up to 7% of emergency patients in this series could not be operated on clearly because of lack of ICU beds.

Only 0.3% of our patients had a stapler device employed for their surgery with no case being done laparoscopically during the review period. This highlights the gulf in surgical practice between the LMIC and the high-income countries (HIC) where most procedures are done through minimal access with staplers being the norm rather than the exception[26]. Large bowel obstruction from a malignancy followed by sigmoid volvulus and adhesions were the commonest indication for an emergency procedure in this series while colon and rectalmalignancy was the predominant indication for an elective colon or rectal surgery. In observing the trend in frequency of volvulus in the preceding 5 decades, where-in 50% of large bowel obstruction was attributed to volvulus[7] to our present finding of 9%, that tallies with the rates of 8% seen in other parts of Africa and 9.2% in the Middle East[29, 30], but clearly higher than the North American rates of d" 4%[31]. In either the emergency or elective colon/ rectal surgeries, colon and rectal cancer presentation was mainly stages III and II respectively, thus confirming that where colorectal cancer screening is scarce, patients present with late stage disease[5].

In conclusion, like other reports large bowel obstruction due to malignancy is the leading cause of emergency colon surgery. LBO complicated with perforation and gangrene is a major risk factor for morbidity and mortality in colorectal surgery in our setting. Hand sewn anastomosis is still the predominant method of restoring bowel continuity after resection of colon or rectum.

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